

PATENT ABSTRACTS OF JAPAN

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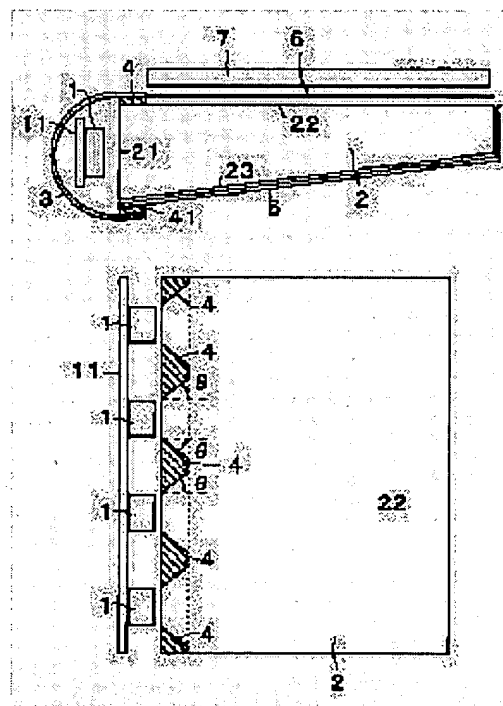
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(54) SURFACE LIGHT SOURCE DEVICE AND DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a surface light source device capable of presenting uniform luminance without providing special both-surface tapes by using a point light source as a light source and suppressing the number of point light sources to be provided and to provided a display device with satisfactory display performance using the surface light source device.

SOLUTION: By partially providing both-surface tapes 4 for fixing one end of a reflection sheet 3 at a plurality of corresponding positions between an LED 1 and an LED 1, in the vicinity of an incident plane 2 on an outgoing plane 22 and forming each of the both-surface tapes 4 into a tapered shape according to spreading of light from each of the LEDs 1, light quantity insufficiency between the LEDs 1 can be compensated, securing luminance by efficient utilization of light from the LEDs 1. The number of the LEDs 1 to be provided is suppressed, and luminance unevenness can be eliminated and luminance of outgoing light can be made uniform without using special both-surface tapes.



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CLAIMS

[Claim(s)]

[Claim 1] The light guide plate which has the outgoing radiation side which carries out outgoing radiation of the light which carried out incidence from the plane of incidence to which opposite arrangement of two or more point light sources and two or more point light sources is carried out, and incidence of the light from the point light source is carried out, and plane of incidence, It is surface light source equipment which is equipped with the reflective member for carrying out incidence of the light from the point light source to plane of incidence, and is characterized by having pasted up the end of a reflective member in two or more parts which correspond between the point light sources near the plane of incidence on an outgoing radiation side.

[Claim 2] The end of a reflective member is surface light source equipment according to claim 1 characterized by having pasted up in the shape of [which was doubled in two or more parts on the outgoing radiation side at the breadth of the light from the point light source] a taper.

[Claim 3] The end of a reflective member and two or more parts which an outgoing radiation side pastes up are surface light source equipment according to claim 2 characterized by having the inclination of about 42.2 degrees to the direction which goes to plane of incidence direct.

[Claim 4] The end of a reflective member is surface light source equipment according to claim 1 to 3 characterized by having pasted up on an outgoing radiation side by the adhesion material which has optical diffusibility.

[Claim 5] The display characterized by having surface light source equipment according to claim 1 to 4 and the non-emitting light display means formed in the outgoing radiation side side of a light guide plate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to what carries out adhesion immobilization of the reflective sheet for reflecting the light from the point light source and introducing into a light guide plate about the display which used surface light source equipment and its surface light source equipment, using the point light sources, such as LED, especially as the light source with a double-sided tape etc. at a light guide plate.

[0002]

[Description of the Prior Art] In the indicating equipment represented by the liquid crystal display non-emitting light, in case it is included in products, such as a digital still camera, a video camera, or a liquid crystal television, the back light unit which is surface light source equipment is prepared in an equipment tooth back for the lighting, for example. What consists of reflecting plates for returning again the light which was prepared in the lens sheet [for condensing the light guide plate which carries out incidence of the light from the light source and the light source from the side, and carries out outgoing radiation from the whole front face as one structure of this back light unit, and the light (Hikaru Idei) by which outgoing radiation is carried out from a light guide plate front face in an angle of visibility, and raising brightness], and light guide plate rear-face side, and fell out from the rear face in a light guide plate is known. And in order to introduce the light from the light source into a light guide plate, except for the light guide plate of the light source, and the end face which counters, a reflective sheet (light source light reflex sheet) is installed in a perimeter. This reflective sheet is usually fixed around the photoconductive close end face of a light guide plate (for example, plane-of-incidence side edge section of an outgoing radiation side and a rear face) with a double-sided tape.

[0003] Now, when introducing the light from the light source from the side of a light guide plate, the point light sources of a cold cathode fluorescent lamp etc., such as a linear light source and LED, are used as the light source. When using the point light sources, such as LED, as the light source, two or more two or more point light sources are installed to the optical plane of incidence of a light guide plate. Although a cost cut and reduction-izing of power consumption were possible for the point light sources, such as LED, compared with the linear light source of a cold cathode fluorescent lamp etc., the part between the point light sources became dark to the brightness of the direct anterior part of the point light source, and there was a problem that brightness unevenness occurred. Although it is possible to reduce this if distance between the point light sources is made small to this brightness unevenness, if it does so, many point light sources are required, and the merit using the point light source will fade.

[0004] Moreover, brightness unevenness originates also in fixing the reflective sheet prepared in the perimeter of the light source with a double-sided tape, and is generated. When a reflective sheet was fixed with a double-sided tape, diffusion of unnecessary refraction, scattered reflection, etc. broke out in the light guide plate part which is non-transparence since the double-sided tape is using the nonwoven fabric as the base, and a double-sided tape pastes up, and, as for a part of optical outgoing radiation side, brightness unevenness had generated light brightly unusually. As opposed to the brightness unevenness

which happens with this double-sided tape, brightness unevenness is reduced by JP,8-54624,A by using what colored the double-sided tape which fixes a reflective sheet so that light might be absorbed, and the thing which added the graphite.

[0005]

[Problem(s) to be Solved by the Invention] As mentioned above, in order to reduce brightness unevenness, when using the point light sources, such as LED, as the light source, many point light sources were required, or a special double-sided tape which absorbs light was needed. Moreover, in order to reduce brightness unevenness, after making the special double-sided tape absorb light, light from the light source can be used efficiently and there was also a possibility that illumination intensity might fall. These cause the cost rise as surface light source equipment and a display, and the competitive strength in a commercial scene may decline.

[0006] this invention -- ** -- it aims at offering a display with the still more sufficient display engine performance using the surface light source equipment for the purpose of offering the surface light source equipment which can present uniform brightness, without stopping the number of the point light sources which it has, and having a special double-sided tape, when it was made in view of the point [like] and uses the point light source as the light source.

[0007]

[Means for Solving the Problem] The light guide plate with which, as for the surface light source equipment of this invention concerning claim 1, two or more point light sources and two or more point light sources have the outgoing radiation side which carries out outgoing radiation of the light which carried out incidence from the plane of incidence to which opposite arrangement is carried out and incidence of the light from the point light source is carried out, and plane of incidence, It has a reflective member for carrying out incidence of the light from the point light source to plane of incidence, and the end of a reflective member is characterized by having pasted up in two or more parts which correspond between the point light sources near the plane of incidence on an outgoing radiation side.

[0008] It is characterized by the surface light source equipment of this invention concerning claim 2 having pasted up the end of a reflective member in invention according to claim 1 in the shape of [which was doubled in two or more parts on the outgoing radiation side at the breadth of the light from the point light source] a taper.

[0009] Two or more parts on which the end and outgoing radiation side of a reflective member paste up the surface light source equipment of this invention concerning claim 3 in invention according to claim 2 are characterized by having the inclination of about 42.2 degrees to the direction which goes to plane of incidence direct.

[0010] It is characterized by the surface light source equipment of this invention concerning claim 4 having pasted up the end of a reflective member on an outgoing radiation side in invention according to claim 1 to 3 by the adhesion material which has optical diffusibility.

[0011] The display of this invention concerning claim 5 is characterized by having surface light source equipment according to claim 1 to 3 and the non-emitting light display means formed in the outgoing radiation side side of a light guide plate.

[0012]

[Embodiment of the Invention] Drawing 1 is the outline block diagram of the display using the surface light source equipment and it concerning this invention.

[0013] 1 is LED as the point light source, and two or more LED1 is installed in the condition of having estranged on the substrate 11.

[0014] 2 is the light guide plate which consists of translucency ingredients, such as acrylic resin, and it has the plane of incidence 21 to which opposite arrangement of two or more LED1 prepared on the substrate 11 is carried out, and incidence of the light from LED1 is carried out, the outgoing-radiation side 22 which carries out outgoing radiation of the light which carried out incidence, and the rear face 23 which counters an outgoing-radiation side, and the 3rd page of others is a reflector so that the light which carried out incidence in the state of the mirror plane may not leak, and a reflector is had if needed. It is formed in the field where a rear face 23 inclines to the outgoing radiation side 22, or is formed stair-

like so that the outgoing radiation side 22 may present a field parallel to the diffusion plate and liquid crystal display panel which are mentioned later in this case by forming it small for improvement in the outgoing radiation effectiveness of outgoing radiation light as the thickness of a light guide plate 2, i.e., the distance of the outgoing radiation side 22 and a rear face 23, separates from plane of incidence 21. Moreover, although not illustrated, the diffusion pattern as a diffusion means by which the pattern design was carried out so that the light by which incidence was carried out might carry out outgoing radiation by uniform brightness from the outgoing radiation side 22 may be formed in the rear face 23.

** -- the general forming cycle using metal mold since a light guide plate [like] is usually formed by injection molding which used thermoplastics, even if it has a diffusion pattern -- ** -- a light guide plate [like] is formed in one and easily.

[0015] 3 is a reflective sheet as a reflective member for carrying out incidence of the light from LED1 to plane of incidence 21, and the inside is constituted by the reflector of white or silver foil, and it is prepared so that an inside may cover LED1 and a reflector 21 may be turned to. 4 and 41 are the double-sided tapes as adhesion material for fixing the reflective sheet 3, and it is respectively stuck in order to fix on the reflecting plate with which a double-sided tape 4 mentions the end of the reflective sheet 3 later, and a double-sided tape 41 mentions the other end of the reflective sheet 3 later on the outgoing radiation side 22. Although a double-sided tape 4 is stuck on the outgoing radiation side 22, as shown in drawing 2, it is partially prepared in two or more locations which corresponded between LED1 and LED1 by about 21 plane of incidence. And each of a double-sided tape 4 is formed in the shape of a taper according to the breadth of the light from LED1. Preferably [when forming a double-sided tape 4 in the shape of a taper], if a light guide plate 2 sets to theta the include angle to the direction in which it goes direct with plane of incidence 21 when a refractive index is $n = 1.49$ by the product made of acrylic resin, it will be formed in the shape of [with the include angle used as $\sin \theta / \sin 90 \text{ degree} = 1/1.49$ i.e., the inclination of $\theta = 42.155 \text{ degrees}$ (about 42.2 degrees),] a taper.

[0016] 5 is the reflecting plate with which opposite arrangement is carried out with a rear face 23, and the rear face 23 and the field which counters are a reflector, and is for returning again the light which leaked from the rear face 23 in a light guide plate 2. The diffusion plate for 6 being countered and prepared in the outgoing radiation side 22, and distributing outgoing radiation light over homogeneity and 7 are the liquid crystal display panels of the transparency mold as a non-emitting light display means formed in the outgoing radiation side 22 side through the diffusion plate 6. Moreover, although not illustrated, a lens sheet may be prepared if needed between the liquid crystal display panel 7 and the diffusion plate 6 or between the diffusion plate 6 and a light guide plate 2, and these diffusion plate 6 and a lens sheet are suitably prepared according to a desired property.

[0017] Now, it is reflected by the direct or reflective sheet 3, and incidence of the light from LED1 is carried out into a light guide plate 2 from plane of incidence 21. At this time, there is much quantity of light of the light by which incidence is carried out to plane of incidence 21 in the part which LED1 counters, and there is in the part corresponding to between LED1 and LED1. [little] However, the light by which incidence was carried out is a part in contact with the double-sided tape 4 for fixing the reflective sheet 3 in the outgoing radiation side 22, and is diffused more greatly than a part without a double-sided tape 4. Supply of light will be carried out also about the part corresponding to between LED1 and LED1 by this diffusion, and the quantity of light of this part is compensated by it.

[0018] It ** and supply of a uniform light is attained by diffusion in the attachment part of a double-sided tape 4 in the field (plane of incidence 21 and opposite side) in which light advances from a double-sided tape 4. And while the light which carried out incidence of the light which passed through diffusion in the attachment part of a double-sided tape 4 spreads the inside of a light guide plate 2, a certain thing is reflected direct or in respect of others, and it once comes out from a rear face 23, and is reflected with a reflecting plate 5, a certain thing enters in a light guide plate 2 again, and outgoing radiation is carried out from the outgoing radiation side 22. The light which carried out outgoing radiation illuminates the liquid crystal display panel 7 from a tooth back through the diffusion plate 6 from the outgoing radiation side 22.

[0019] Thus, the lack of the quantity of light between LED can be compensated by forming partially the

double-sided tape 4 for fixing the end of the reflective sheet 3 in two or more locations which corresponded between LED1 and LED1 by about 21 plane of incidence, doubling each of a double-sided tape 4 with the breadth of the light from LED1 further, and forming in the shape of a taper.

Consequently, brightness unevenness is canceled and equalization of the brightness of outgoing radiation light can be attained. And offer of the surface light source equipment which has little good lighting engine performance of brightness unevenness can be performed, and offer of the display which has the further excellent display engine performance is attained.

[0020] Moreover, since the lack of the quantity of light between LED can be compensated securing brightness using the light from LED efficiently, it becomes possible to lengthen distance while LED is arranged, and the need of having much LED for the quantity of light compensation between LED is lost. Furthermore, a cost cut becomes possible that what is necessary is just to use an ordinary double-sided tape for the double-sided tape which the reflective sheet 3 fixes.

[0021] In addition, although the adhesion material which makes a double-sided tape representation is used for adhesion immobilization with the reflective sheet 3 and an outgoing radiation side in this example, this invention is not restricted to this and may be pasted up with adhesives. If a reflective sheet causes optical white diffusion at this time, the effectiveness of this invention can fully be acquired by using the adhesives which have optical diffusibility, when it is what the adhesives of transparence are sufficient as and does not cause optical diffusibility.

[0022]

[Effect of the Invention] This invention can compensate the lack of the quantity of light between LED, securing the brightness by effectiveness use of the light from LED by preparing partially the double-sided tape for fixing the end of a reflective sheet in two or more locations which corresponded between LED near the plane of incidence on the outgoing radiation side, doubling each of a double-sided tape with the breadth of the light from LED further, and forming in the shape of a taper so that clearly from the above explanation. Without this stopping the number of LED which it has, and using a special double-sided tape, brightness unevenness is canceled and equalization of the brightness of outgoing radiation light can be attained. And the cost can be cut down, offer of the surface light source equipment which has little good lighting engine performance of brightness unevenness can be performed, and offer of the display which has the further excellent display engine performance is attained.

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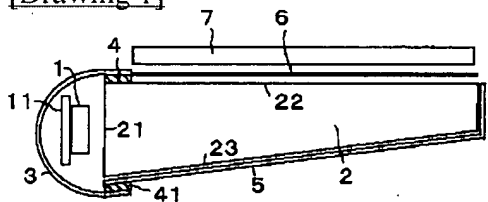
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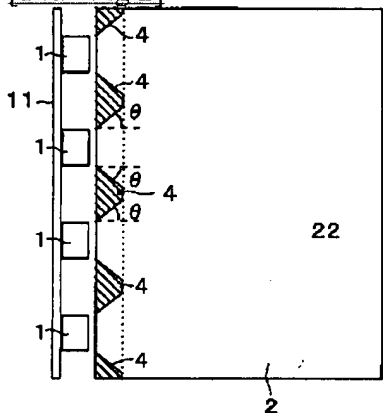
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DRAWINGS

[Drawing 1]



[Drawing 2]



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